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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/784,751 | 02/23/2004 | Timothy Daniel Kostar | 13DV-14085 (07783-0113) | 2241 |
| 31450 7590 04/25/2008 MCNEES WALLACE & NURICK LLC 100 PINE STREET P.O. BOX 1166 HARRISBURG, PA 17108-1166 | | | EXAMINER MATZEK, MATTHEW D | |
| | | | ART UNIT 1794 | PAPER NUMBER |
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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|------------------------------|--------------------------------------|--------------------------------------|--|
| Office Action Summary | Application No. 10/784,751 | Applicant(s) KOSTAR ET AL. | |
| | Examiner MATTHEW D. MATZEK | Art Unit 1794 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 February 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-5,8-20 and 28-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-5,8-20 and 28-31 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Response to Amendment

1. The amendment dated 2/5/2008 has been fully considered and entered into the Record. Claim 1 has been amended; the amended claim contains no new matter. Claims 2, 6, 7 and 21-27 have been canceled. Claims 1, 3-5, 8-20 and 28-31 are currently active.

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1, 3-5, 8-18 and 28-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tani (US 2003/0145934) in view of Hillig et al. (US 4,917,941).

a. Tani teaches a process for producing a fiber-reinforced silicon carbide composite offering high toughness comprising a multiple layer laminate (Abstract). Woven, nonwoven and unidirectional preregs of silicon carbide fiber are available to reinforce the silicon carbide matrix [0014, 0015]. The voids between the fibers of each layer of the composite are filled with polymeric resins and silicon. The matrix serves to impregnate or infiltrate the spaces between the fibers of the fabric support layers [0019 and 0020]. Following heat-treatment the two components form a porous silicon carbide matrix that links the fibers of each layer of the laminate (Abstract, 0006)]. The laminate of Example 3 comprises two layers of nonwoven and two layers of woven silicon carbide fabrics laminated in alternating order creating a laminate combination of nonwoven/woven/nonwoven/woven. Unidirectional fiber preregs, which comprise continuous fibers, may replace the woven fabric layers [0014]. Replacing the woven fabric layers of Example 3 with unidirectional fiber prepreg layers creates a ceramic

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matrix composite laminate with a nonwoven layer in between two layers of unidirectional fiber prepreg. The invention of Tani is silent as to the use of chopped ceramic fibers in the creation of the nonwoven fabric layer.

b. Hillig et al. teach a fiber and a filament containing ceramic preform comprised of a mixture of discontinuous fibers surrounding a layer of continuous filaments extending through the mixture. The mixture is produced by and infiltrated with a molten ceramic to produce a composite (Abstract). The continuous fibers provide reserve strength to the composite should it crack and the discontinuous fibers provide toughness to the composite (col. 1, line 61-col. 2, line 12). The discontinuous fibers may be chopped silicon carbide fibers or a mixture of different ceramic fibers (col. 3, lines 1-20). The continuous fibers may be made of silicon carbide or a mixture of different ceramic fibers (col. 5, lines 43-49). Hillig et al. also show that is it advantageous for the ceramic matrix to comprise at least 50 percent of the chopped fiber layer (col. 11, lines 10-14). Therefore, claims 12 and 13 are rejected.

c. The structure of the applied article has a layer containing a plurality of continuous ceramic filaments adjacent a layer of chopped ceramic fibers located in a continuous matrix phase which is adjacent another layer containing a plurality of continuous ceramic filaments (claim 5). A number of chemical species are available for use as the infiltrant to create the continuous matrix including ceramics (col. 4, lines 1-14). The continuous matrix phase is to be distributed evenly throughout the composite to create the instantly claimed infiltrated article (col. 11, lines 6-13). Claim 5 is rejected as the ceramic fibers may have a length of from about 10 to about 2000 microns (0.0004 to 0.08 inches) (col.

3, lines 13-15). Claim 14 is rejected as the ceramic chopped fibers have diameters up to 10 microns (0.0004 inches) (col. 3, lines 10-15).

a. Claims 8-11 are rejected as the matrix phase of the applied invention is designed to fill the space the between adjacent layers of continuous filaments thereby reducing the number of inter-laminar voids, size and volume fraction of said voids. The most preferred embodiment is a completely pore-free composite (col. 10, lines 61-64).

b. Since Tani and Hillig et al. are from the same field of endeavor (i.e. fiber-reinforced silicon carbide composites), the purpose disclosed by Hillig et al. would have been recognized in the pertinent art of Tani.

c. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to have made the nonwoven layers of Tani with the chopped ceramic fibers of Hillig et al. and formed a composite without any remaining voids. The skilled artisan would have been motivated by the desire to provide the composite with toughness (col. 1, line 61-col. 2, line 12, Hillig et al.).

d. Hillig et al. teach a chopped fiber mat thickness of 0.02" (Example 1). Tani and Hillig et al. disclose the claimed invention except for the nonwoven mat thickness of claim 3. Absent a teaching of the criticality of the nonwoven chopped fiber mat of claim 3 it would have been obvious to one having ordinary skill in the art at the time the invention was made to have made a thinner nonwoven mat layer between 0.001 and 0.002 inches thick, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233. A thinner nonwoven mat would allow

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for the stronger unidirectional fiber layers to make up more of the ceramic composite improving its total strength.

e. Claim 4 is rejected as the discontinuous fibers of the chopped fiber layer of Hillig et al. are randomly oriented and then infiltrated with ceramic matrix.

f. The limitation of using a “compressed nonwoven mat” between the preform lamina is met by the applied art in that the structure and composition of the claimed article is provided by Tani and Hillig et al. and the “compressed” limitation would not materially affect the structure of the claimed nonwoven mat that is already very thin or distinguish it from the mat of Hillig et al. (0.02” thick). Furthermore, the articles disclosed in Tani and Hillig et al. are laminated, which results in a “compressed” article.

3. Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tani (US 2003/0145934) in view of Hillig et al. (US 4,917,941) as applied to claim 1 above, and further in view of Colegrove et al. (US 6,096,669). The inventions of Tani and Hillig et al. are silent as to the use of multiple layers between the continuous fiber perform lamina.

a. Colegrove et al. teach a preform suitable for use in creating a composite laminate (Abstract). Figure 5 shows an embodiment of the perform comprising a nonwoven layer **20**, resin **8**, and unidirectional fiber layer **10**. The unidirectional fibers may be silicon carbide (col. 4, lines 24-26) and the nonwoven mat may be made of chopped silicon carbide fibers (col. 4, lines 52-55). Multiple plies of the Colegrove et al. invention may be laminated together (col. 5, lines 49-53). The lamination of two preforms of Figure 5 with the nonwoven layers **20** would result in a symmetric article with two nonwoven layer adjacent layers of resin **8**, and adjacent two layers of unidirectional layers **10**.

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b. Since Tani and Colegrove et al. are from the same field of endeavor (i.e. silicon carbide fiber composites), the purpose disclosed by Colegrove et al. would have been recognized in the pertinent art of Tani.

c. It would have been obvious at the time the invention was made to a person having ordinary skill in the art to modify the article of Tani and Hillig et al. to include multiple layers of the nonwoven mat of Tani between the layers of directional continuous ceramic fibers. The skilled artisan would have been motivated by the desire to create an article that possesses enhanced thermal properties with the inclusion of additional chopped silicon carbide fibers. The enhanced thermal property allows the composite to have a more uniform thermal expansion, thereby decreasing the thermal stresses that buildup due to mismatched coefficient of thermal expansions between its phases.

Response to Arguments

4. Applicant's arguments filed 2/5/2008 have been fully considered but they are not persuasive.

5. Applicant argues that just because the references can be combined or modified does not render the resultant obvious unless the prior art suggests the desirability of the combination. Examiner has relied upon Hillig et al. for the motivation to combine the two references to arrive at the claimed invention.

6. Applicant argues that if the proposed modification or combination of the prior art would change the principle or operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. The combination of

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Tani and Hillig does not change the principle or operation of the prior art invention of Tani as both references are directed to ceramic composites concerned with toughness.

7. Applicant argues that not all of the claimed limitations are provided for the in combination of the applied prior art. In particular, Applicant asserts that since the chopped fibers of Hillig are dried and then impregnated they serve to solve a different purpose than of Applicant. Examiner has not relied upon the chopped fiber structure of Hillig to modify Tani, rather the use of chopped fibers of Hillig to make the nonwoven taught by Tani, which would serve to solve issues pertaining to minimizing voidage in the composite and improve its toughness. A holding of obviousness can be based on a showing that there was “an apparent reason to combine the known elements in the fashion claimed.” KSR, 127 S. Ct. at 1740-41, 82 USPQ2d at 1396. In other words, “there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” Id., 127 S. Ct. at 1741, 82 USPQ2d at 1396 (quoting In re Kahn, 441 F.3d 977, 987, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006)). However, this reasoning is not limited to the problem the patentee was trying to solve; “any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed,” KSR, 127 S. Ct. at 1742, 82 USPQ2d at 1397 (emphasis added).

8. Applicant argues that one of ordinary skill would not look to Hillig to modify Tani, because Hillig does not use preforms, but rather individual fibers. While Hillig may use individual fibers over preforms, the issue of decreased strength between continuous fiber layers would necessarily be present in both inventions and the use of the chopped fiber would alleviate

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working strain for the composite prior to matrix failure and reserve strength should such matrix failure occur.

9. Applicant argues that there is no reasonable expectation of success when combining the chopped fibers of Hillig into the invention of Tani. As Examiner has pointed out earlier, he has relied upon the Hillig for the teaching of chopped fibers, but is using the chopped fibers in the nonwoven of Tani that is pre-existing.

10. Applicant argues that even if the chopped fibers of Hillig are used to form a nonwoven prepreg of Tani it still fails to provide for "a compressed nonwoven mat". As pointed out in the rejection section of this action, The limitation of using a "compressed nonwoven mat" between the preform lamina is met by the applied art in that the structure and composition of the claimed article is provided by Tani and Hillig et al. and the "compressed" limitation would not materially affect the structure of the claimed nonwoven mat that is already very thin or distinguish it from the mat of Hillig et al. (0.02" thick). Furthermore, the articles disclosed in Tani and Hillig et al. are laminated, which results in a "compressed" nonwoven.

11. Applicant argues that even if the chopped fibers of Hillig are used to form a nonwoven prepreg of Tani it still fails to substantially remove the interface between the adjacent preform lamina. As demonstrated in the rejection section *supra*, the disclosure of Tani provides for at least one nonwoven layer between the adjacent preform lamina. The combined disclosures provide for nonwoven layers of the claimed thickness and as such would necessarily remove the interface between the adjacent preform lamina and the "compressed" limitation. Applicant is encouraged to structurally distinguish the claimed invention's "compressed" nonwoven and that of the applied prior art.

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12. Applicant argues that incorporating the chopped fibers into the nonwoven layer of Tani does not result in a “mat”. Examiner takes the position that a nonwoven fabric comprising chopped fibers constitutes a mat because it is a complete construct that can maintain its structural integrity as a lone article.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW D. MATZEK whose telephone number is (571)272-2423. The examiner can normally be reached on M-F, 9-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Terrel Morris can be reached on 571.272.1478. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Matthew D Matzek/
Examiner, Art Unit 1794

/Arti Singh/
Primary Examiner, Art Unit 1771